

**COMMONLY INTERCEPTED THRIPS (THYSANOPTERA) FROM EUROPE,
THE MEDITERRANEAN, AND AFRICA AT U.S. PORTS-OF-ENTRY. PART II.
FRANKLINIELLA KARNY AND *IRIDOTHRIPS* PRIESNER (THRIPIDAE)**

DAVID A. NICKLE

Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture, Building 005, BARC-West, 10300 Baltimore Avenue, Beltsville, MD 20705-2350, U.S.A. (e-mail: dnickle@sel.barc.usda.gov)

Abstract.—A total of 130 species of thrips occurring in Africa, Europe, and the Mediterranean region were intercepted by U. S. agricultural quarantine officers in shipments of plants and cut flowers at the various ports-of-entry in the United States from 1983 to 1999. Of these, four species of *Frankliniella* (*F. occidentalis* Pergande, *F. intonsa* Trybom, *F. schultzei* (Trybom), and *F. tenuicornis* (Uzel) rank within the top ten most frequently encountered species over this time period. This paper is Part II of a guide to the identification of thrips coming into this country from those regions; it uses keys, line drawings, and scanning electron micrographs to identify the commonly intercepted species of the genera *Frankliniella* (with 9 species from that region) and *Iridothrips* (with 2 species)—both of which are characterized by the presence of ctenidia located anteriorly of abdominal spiracle VIII. It is designed primarily to aid the identification capabilities of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA, APHIS) identifiers at U.S. ports-of-entry, but those interested in thrips in general will also benefit from this information.

Key Words: thrips, pests of flowers, Europe, Africa

This paper is the second of a series intended to facilitate identification of thrips species commonly intercepted at U.S. ports on a wide range of agricultural commodities from Africa, Europe, and the Mediterranean region. It lists the most commonly encountered species of *Frankliniella* Priesner, 1940 and *Iridothrips* Karny, 1910, and presents identification keys to the relevant species. *Frankliniella* and *Iridothrips* are characterized by having ctenidia anteriorly of abdominal spiracle VIII. They are similar to *Baliothrips* Uzel, 1895, *Isochaetothrips* Moulton, 1928, *Microcephalothrips* Bagnall, 1926, and *Thrips* Linnaeus, 1758. These genera differ by having ctenidia on abdominal tergite VIII located posteriorly of abdominal spiracle VIII.

Frankliniella is the second largest genus of thripine Thysanoptera, with 151 New World and 7 Palearctic species (Nakahara 1997). They include major agricultural pests, and several species are vectors of various tospoviruses (Wijkamp et al. 1995). Since most species feed on pollens, they are often intercepted at U.S. ports-of-entry in a wide variety of flowers. Although *Iridothrips* was synonymized as an aberrant form of *Frankliniella* by Mound et al. (1976), it was reinstated as a valid genus by Chaisson (1986), with two species—*I. iridis* (Watson, 1924) and *I. mariae* Pelikán, 1961. Both of these species have simple sense cones on antennal segment III.

This paper is based on the adult female.

Males seldom are encountered by port inspectors; nevertheless, the male apical abdominal segments of *F. occidentalis* Pergande, 1895 are figured for the purpose of comparison (Figs. 21–22). Immature stages (Fig. 24) are not treated, since a useful key to second-instar larvae of *F. occidentalis*, *F. fusca* (Hinds, 1902), *F. nigriventris* (Uzel, 1895), *F. tenuicornis* (Uzel, 1895), *F. schultzei* (Trybom, 1910), *F. intonsa* (Trybom, 1895), and *F. pallida* (Uzel, 1895) occurring in Europe has been published (Nakahara and Vierbergen 1998).

MATERIALS AND METHODS

The same databases utilized by Nickle (2003) were used in this paper to provide information on the frequency of interceptions, host information, and geographic origin of the species covered. The first database contained a total of 2,437 interceptions, while the second database yielded a total of 497 specimens, providing a broad basis upon which to generalize.

Specimens used in scanning electron micrographs were obtained from recent incoming material for urgent identifications. Some of the specimens were cleared and slide mounted in Hoyer's for preliminary identifications, then removed from the slides, placed in 80% ethanol for later preparation for scanning electron micrographs (SEMs). Specimens to be prepared for SEMs were transferred overnight into 100% ethanol. They were then critical point dried, using a Samway[™] critical point dryer. Dried specimens were glued to SEM stubs and photomicrographed in an Amray 1810[™] scanning electron microscope. The images were digitally captured and transferred to Adobe Photoshop 5.5[®] for Mac-Intosh, where they were edited for publication.

Line drawing figures of specimens were rendered from images observed through a camera lucida attached to a Zeiss Axioskop 2[®] microscope, using both transmitted light and phase-contrast modes and modified using various methods with Adobe Photosh-

op. Morphological features are those described by Mound and Nakahara (1993).

RESULTS

Of 159 species of *Frankliniella* (Nakahara 1997), only ten species occur in Europe, Africa, and the Mediterranean region, and of these only four are regularly intercepted at U.S. ports-of-entry. Since *Frankliniella nigriventris* (from eastern Europe) and *F. tristis* (found in turf in Austria, Estonia, and the Ukraine) have never been intercepted in any shipments from the region and are rare, even in museum collections, they are not covered in this paper. Two species of *Iridothrips* have been described; both are found in Europe (Jacot-Guillarmod 1974), but only one (*I. iridis*) is sporadically intercepted. *Iridothrips mariae* has never been intercepted; it is covered in this paper only briefly, in the unlikely event that it too may be intercepted in future shipments from Europe. The following is a list of *Iridothrips* and *Frankliniella* species known to occur in Europe, Africa, and the Mediterranean region. Their distributions and frequency of interceptions at ports-of-entry between 1983 and 1999 are indicated in Table 1.

Iridothrips Karny, 1910

iridis (Watson, 1924)

mariae Pelikan, 1961 [No interceptions between 1983 and 1999]

Frankliniella Priesner, 1940

borinquen Hood, 1942

fusca Hinds, 1902

intonsa (Trybom, 1895)

nigriventris (Uzel, 1895) [No interceptions in this time period but may show up in future]

occidentalis (Pergande, 1895)

pallida (Uzel, 1895)

schultzei (Trybom, 1910)

tenuicornis (Uzel, 1895)

tristis Priesner, 1920 [No interceptions in this time period but may show up in future]

Table 1. Species of thrips intercepted at ports-of-entry (numbers represent accumulated interceptions over the period 1983–1993). Ranges of species in Europe, Africa, and the Mediterranean region are indicated with an “x”. Establishment or occurrence of any of these species in the United States and South America also is indicated by an “x”. Species not intercepted during this time period are indicated with “y”.

Species	No. of Interceptions	Eur.	Med.	Afr.	U.S.	S. Am.
<i>Frankliniella</i> Karny, 1910						
<i>borinquen</i> Hood, 1900	2					
<i>fusca</i> (Hinds, 1902)	7	Neth.			x	
<i>gossypiana</i> Hood, 1900	1				x	
<i>intonsa</i> (Trybom, 1895)	94	x	x		x	
<i>nigriventris</i> (Uzel, 1895)	y	x		x	x	x
<i>occidentalis</i> (Pergande, 1895)	448	x	x	x	x	
<i>pallida</i> (Uzel, 1895)	1	x				
<i>panamensis</i> Hood, 1900	1					
<i>schultzei</i> (Trybom, 1910)	55	x	x	x	x	x
<i>tenuicornis</i> (Uzel, 1895)	136					
<i>tristis</i> Priesner, 1920	y				x	
<i>tritici</i> (Fitch, 1855)	3	x				
undetermined species	72	x	x		x	
<i>Iridothrips</i> Priesner, 1940						
<i>iridis</i> (Watson, 1924)	2	x				
<i>mariae</i> Pelikán, 1961	y	x			x	

The 1983–99 database (see Table 1, Nickle 2003) was evaluated to determine the ranges of *Frankliniella* and *Iridothrips* species intercepted from Africa, the Mediterranean, and Europe. Since 1983, ten species of *Frankliniella* and one species of *Iridothrips* were intercepted from shipments arriving from Europe, Africa, and the Mediterranean. Three of the *Frankliniella* species—*F. panamensis* Hood (n = 2) (Figs. 4, 10, 16), *F. tritici* (Fitch) (n = 4), and *F. gossypiana* Hood (n = 1)—are Nearctic or Neotropical species and apparently do not occur in Africa, Europe, or the Mediterranean region but were among those intercepted from Europe. *Frankliniella gossypiana* almost certainly was not among shipments from Europe when it was intercepted at a single U.S. port within its homeland range, but *F. panamensis* and *F. tritici* are more likely to have been transported by commerce into the above foreign regions. These latter two species are included in the following key because they may again be encountered in future samples from these

regions at U.S. ports-of-entry. Another Neotropical species—*F. borinquen* (n = 2)—is apparently now established in Kenya (Vierbergen 1995); it is also included in the key.

Of the 751 records of *Frankliniella* identifiable to described species in the 1983–1993 database, 59.6% of the interceptions were attributed to *F. occidentalis* (n = 448), with smaller percentages attributed to *F. intonsa* (n = 94, or 12.5%), *F. schultzei* (n = 55 or 7.3%), and *F. tenuicornis* (n = 136 or 18.1%). The 1994–1999 database shows trends of interceptions of thrips from this region, and four species of *Frankliniella* rank within the top 10 species intercepted (Table 2). *Iridothrips iridis* was intercepted only twice between 1983 and 1999 but was intercepted more frequently in previous years. *Iridothrips mariae* to date has not been encountered in any interceptions arriving from Europe and may actually belong to a different genus (S. Nakahara, personal communication, 2002), but it is presented in the key and figured in the event that in

Table 2. Most frequently intercepted thrips from Europe, Africa, and the Mediterranean region at U.S. ports-of-entry, 1994–1999, based on a database of 497 identified specimens. Species were ranked from most frequently intercepted to species represented by more than unique specimens.

Species	Rank	Number of Interceptions	% of Total (n = 497)	Cumulative Percent
<i>Thrips tabaci</i>	1	81	20.0	20.0
<i>Frankliniella occidentalis</i>	2	59	14.6	34.6
<i>Thrips fuscipennis</i>	3	41	10.1	44.7
<i>Thrips major</i>	4	32	7.9	52.6
<i>Thrips vulgatissimus</i>	5	22	5.4	58.0
<i>Odontothrips karnyi</i>	6	18	4.5	62.2
<i>Frankliniella intonsa</i>	7	15	3.7	65.9
<i>Haplothrips gowdeyi</i>	8	11	2.7	68.6
<i>Frankliniella tenuicornis</i>	9	10	2.4	71.0
<i>Frankliniella schultzei</i>	10	7	1.7	72.7
<i>Frankliniella fusca</i>	10	7	1.7	75.4
<i>Melanthrips fuscus</i>	11	6	1.4	76.8
<i>Thrips meridionalis</i>	12	5	1.2	77.5
<i>Thrips flavus</i>	12	5	1.2	78.7
<i>Limothrips cerealum</i>	12	5	1.2	79.9
<i>Thrips atratus</i>	13	4	0.9	80.8
<i>Haplothrips nigricornis</i>	13	4	0.9	81.7
<i>Aeolothrips collaris</i>	14	3	0.7	82.4
<i>Thrips simplex</i>	14	3	0.7	83.1
<i>Thrips nigropilosus</i>	15	2	0.5	83.6
<i>Neohydatothrips samayunkur</i>	15	2	0.5	84.1
<i>Limothrips denticornis</i>	15	2	0.5	84.6
<i>Aeolothrips deserticola</i>	15	2	0.5	85.1
<i>Thrips australis</i>	15	2	0.5	85.6
<i>Dendrothrips ornatus</i>	15	2	0.5	86.1
All other interceptions	—	56	13.9	100.0

the future it may be intercepted from Europe at U.S. ports.

KEY TO SPECIES OF *IRIDOTHRIPS* AND *FRANKLINIELLA* INTERCEPTED FROM EUROPE/AFRICA/MEDITERRANEAN

- 1. Antennal segments III–IV with simple sense cones (only rarely with weakly forked cones) (Fig. 23) (*Iridothrips* species) 2
 - Antennal segments III–IV with well developed furcate sense cones (see Fig. 30) (*Frankliniella* species) 3
- 2. Sides of head behind eyes parallel; ocellar setae III laterad of anterior ocelli (Fig. 28); posterior margin of tergite VIII without microtrichia, although minor scalloping may be present, or with microtrichia only on lateral margins (Fig. 26); intercoxal process of metasternum apically truncate *I. iridis*
 - Sides of head behind eyes convergent; ocellar setae III located midway between anterior and posterior ocelli (Fig. 29); posterior margin of

- tergite VIII with a complete row of small microtrichia (Fig. 27); intercoxal process of metasternum apically conical *I. mariae*
- 3 Brachypterous or apterous 4
 - Macropterous 5
- 4 Metanotum weakly reticulated with sculpture lines transversely oriented (Fig. 7); median pair of setae positioned in lateral 1/3 of metanotum; metanotum normally without campaniform sensilla; comb of microtrichia on posterior margin of tergite VIII interrupted medially *F. fusca* (in part)
 - Metanotum reticulated in medial 1/3 only, with lateral sculpture lines longitudinally converging; median pair of setae positioned in medial 1/3 of metanotum; metanotum with 2 campaniform sensilla; comb of microtrichia on posterior margin of tergite VIII entire *F. nigriventris*
- 5 Head prolonged anterior to eyes (Fig. 6) 6
 - Head not prolonged anterior to eyes 7
- 6 Head weakly prolonged anterior to eyes; all antennal segments brown or nearly so; meta-

- notum medially reticulated, with reticulations subquadrate *F. fusca* (in part)
- Head more strongly prolonged anterior to eyes; antennal segments III–IV yellow or nearly so; metanotum medially striated (Fig. 12) *F. tenuicornis*
- 7 Posteromarginal comb of tergite VIII complete, with well developed microtrichia (Figs. 14–16) 8
- Posteromarginal comb of tergite VIII absent or medially without microtrichia (Figs. 17–18) 13
- 8 Body color brown 9
- Body color yellow or predominantly yellow (abdomen may be brown in some specimens) 11
- 9 Antennal segment VIII about as long as segment VII; postocular setae iv about $\frac{1}{2}$ to $\frac{2}{3}$ as long as ocellar setae III or shorter (Fig. 2); metanotum without campaniform sensilla *F. intonsa*
- Antennal segment VIII about twice as long as segment VII; postocular setae iv $\frac{1}{3}$ as long as ocellar setae III (Figs. 3–4); metanotum usually with 2 campaniform sensilla 10
- 10 Microtrichia on posterior margin of abdominal tergite VIII 20–27 μm in length and separated from each other by less than $\frac{1}{3}$ their length (Fig. 16) *F. panamensis*
- Microtrichia on posterior margin of abdominal tergite VIII 12–17 μm in length and separated from each other by $\frac{2}{3}$ – $\frac{9}{10}$ their length (Fig. 15) *F. occidentalis* (in part)
- 11 Pedicel of antennal segment III expanded (Fig. 31); length of antennal segment VIII \leq segment VII; metanotum without campaniform sensilla *F. borinquen*
- Pedicel of antennal segment III not as above (Figs. 30, 32–33); length of antennal segment VIII \geq twice the length of segment VII; metanotum with 2 campaniform sensilla 12
- 12 Postocular setae iv much longer than other postocular setae, nearly $\frac{3}{4}$ as long as ocellar setae III; microtrichia on posterior margin of abdominal tergite VIII long, well developed (Fig. 15) *F. occidentalis* (in part)
- Postocular setae iv similar in length to other postocular setae, less than $\frac{1}{2}$ as long as ocellar setae III; microtrichia on posterior margin of abdominal tergite VIII short, with distinct triangular bases (Fig. 25) *F. pallida*
- 13 Ocellar setae III located between anterior and posterior ocelli (Fig. 5) *F. schultzei*
- Ocellar setae III located at edge or outside of ocellar triangle 14
- 14 Pedicel of antennal segment III with distinct dilation, mushroom-shaped (Fig. 32); antennal segments I–IV (and/or V) light yellow *F. tritici*

- Pedicel of antennal segment III without distinct dilation (Fig. 30); All antennal segments brown. *F. fusca* (in part)

Frankliniella Karny, 1910

Diagnosis.—Head usually wider than long; antenna normally 8-segmented, rarely 7-segmented; antennal segments III and IV each with forked sense cones; 3 ocelli present; 3 pairs of ocellar setae, with interocular setae usually well developed and usually located midway between anterior and posterior ocelli; postocular seta IV variable in length; maxillary palpi 3-segmented; pronotum with one pair of anteroangular, one pair of anteromedial, and two pairs of posteroangular long setae, with usually 5 pairs of posteromarginal setae of various lengths with second pair longest; forewings usually macropterous with two complete rows of venal setae regularly distributed, or brachypterous; tarsi 2-segmented; abdominal sternites without accessory discal setae; tergite VIII with ctenidia located anterolaterally to spiracle.

Frankliniella borinquen Hood, 1942

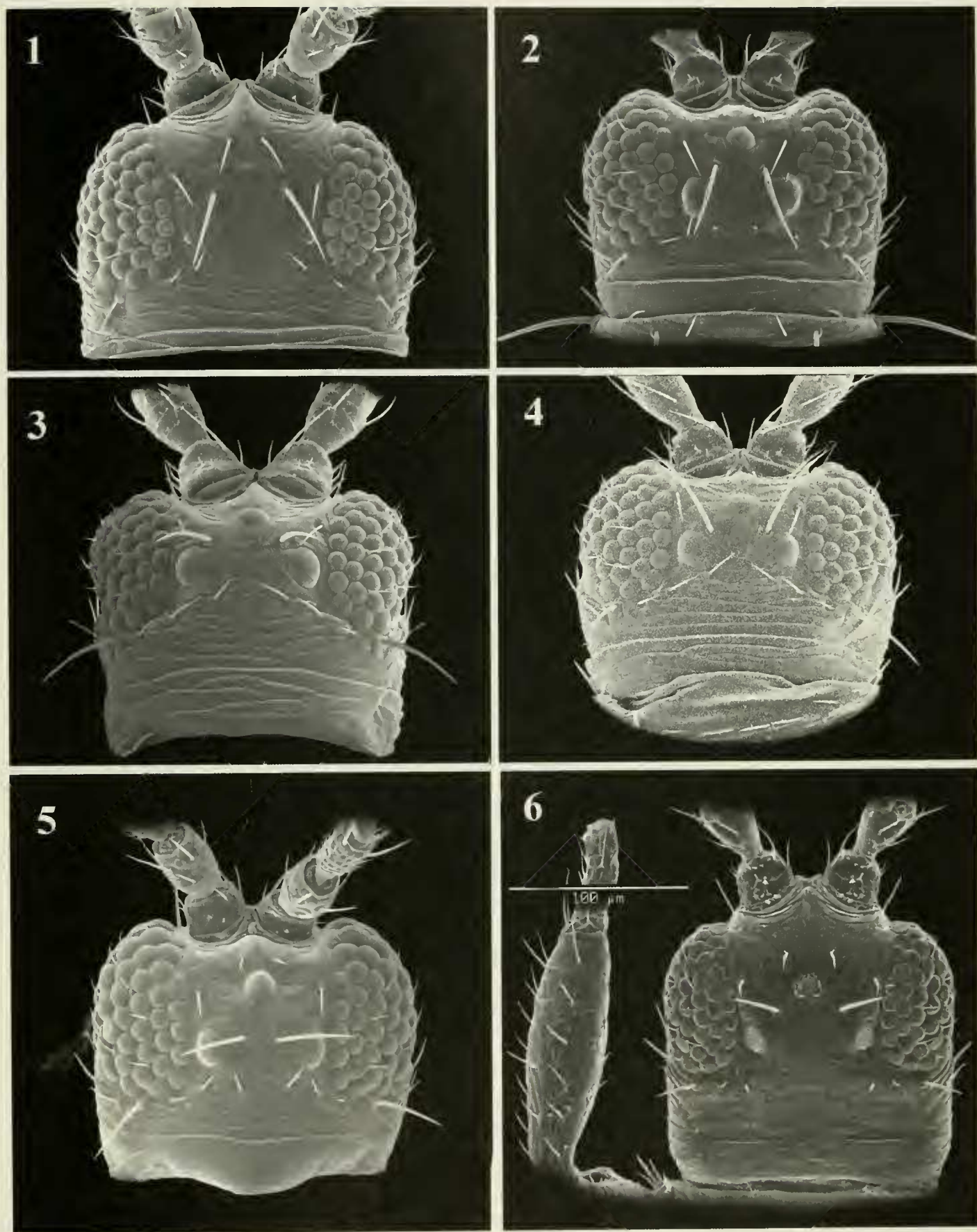
Frankliniella boriquen is a New World species recently thought to be now established in Kenya (Vierbergen 1995). It was intercepted twice in U.S. ports-of-entry between 1983 and 1999: at Dallas, TX, on *Ornithogalum* sp. from the Netherlands, and at Los Angeles, CA, on *Callistephus* sp. from the Netherlands.

Range.—(North America) U.S.A. (TX only), Costa Rica, Cuba, El Salvador, Jamaica, Mexico, Panama, Puerto Rico. (Africa) Kenya.

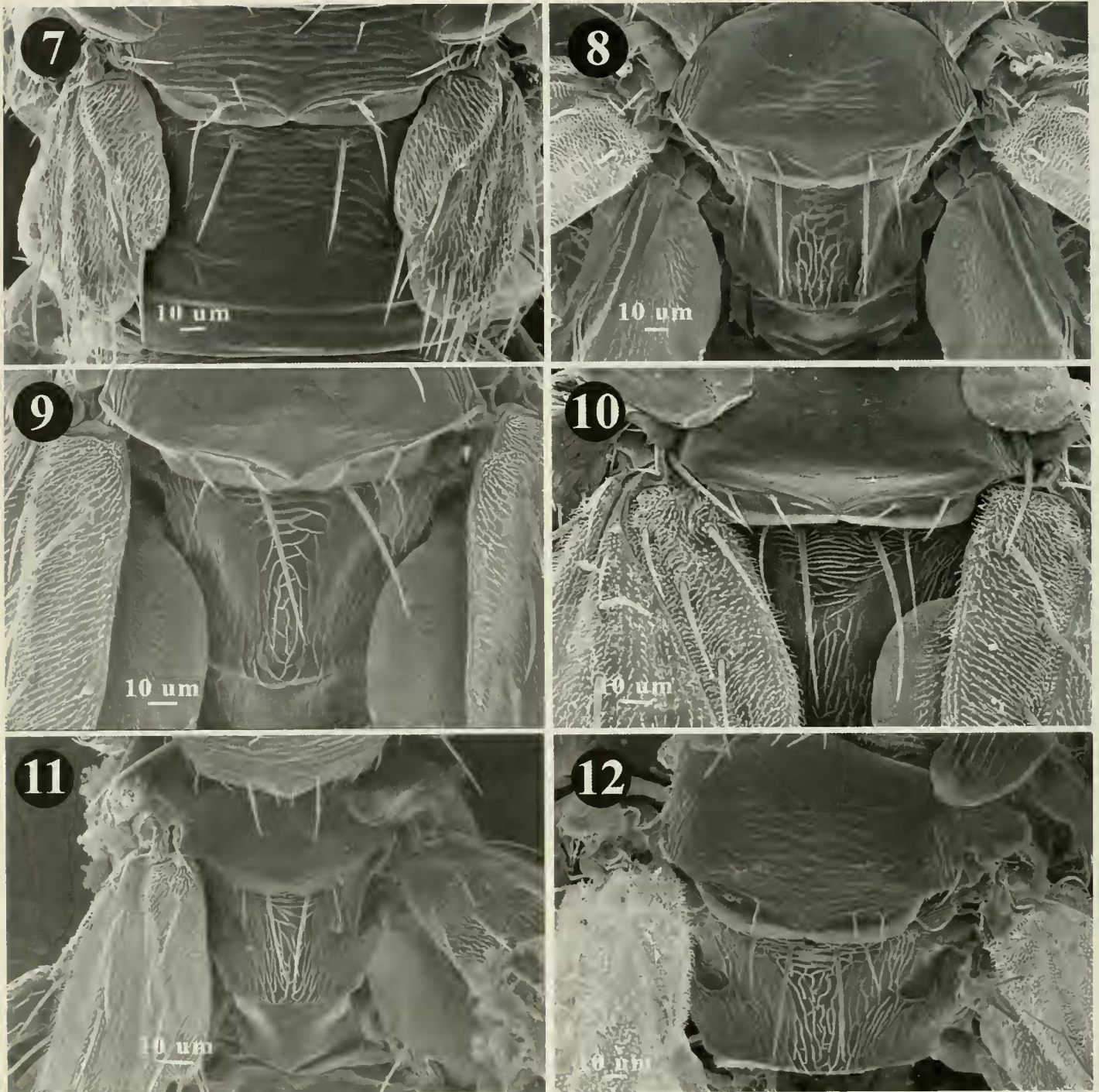
Hosts.—*Bidens pilosa*; *Tithonia diversifolia*; coconuts. Intercepted from Netherlands in *Ornithogalum* sp. [Dallas, TX] and *Callistephus* sp. [Los Angeles, CA].

Frankliniella fusca (Hinds, 1902)
(Figs. 1, 7, 13, 30)

Frankliniella fusca is a North American species recently established in the Netherlands. Nearly all specimens intercepted



Figs. 1–6. Heads of *Frankliniella* species, dorsal views. 1, *F. fusca*. 2, *F. intonsa*. 3, *F. occidentalis*. 4, *F. panamensis*. 5, *F. schultzei*. 6, *F. tenuicornis*.



Figs. 7–12. Meso- and metanota of *Frankliniella* species, dorsal views. 7, *F. fusca*. 8, *F. intonsa*. 9, *F. occidentalis*. 10, *F. panamensis*. 11, *F. schultzei*. 12, *F. tenuicornis*.

from the Netherlands have been brachypterous, but more macropterous forms may be encountered in the future. In the U. S. it is a pest of cotton, peanuts, and tobacco. In brachypterous forms of *F. fusca*, ocelli are vestigial or absent (in brachypterous *F. nigriventris*, they are present), and the microtrichia on the posterior margin of tergite VIII are small and limited to the lateral margins (in brachypterous *F. nigriventris*, they are well developed across the entire

posterior margin). Macropterous *F. fusca* resembles *F. tenuicornis*; the head between the eyes is prolonged anteriorly in both species, although only weakly so in *F. fusca*. Macropterous *F. fusca* differs from *F. tenuicornis* in having broad reticulations in the median sculpturation of the metanotum (median sculpturation in *F. tenuicornis* is striated); also antennal segments III–IV in *F. fusca* is nearly uniformly brown; in *F. tenuicornis* they are light yellow.

Color.—Body usually brown to dark brown.

Range.—(Europe) Netherlands; (North America) U.S.A. (widely distributed); Canada, Mexico. (Oceania) Hawaii.

Hosts.—Wide variety of plants, including grasses.

Frankliniella intonsa (Trybom, 1895)
(Figs. 2, 8, 14, 19)

Frankliniella intonsa is one of the four intercepted species that often reaches pest status in horticultural crops, especially in the flower industry. It is similar in morphology to *F. occidentalis* but can be distinguished from that species by its shorter antennal segment VIII, its shorter fourth postocular setae, absence of campaniform sensilla on metanotum, and its usually darker uniform brown color.

Color.—Body light to dark brown; wings clear; legs concolorous with body; head and pronotum light brown to brown. Antennal segments I and II brown; III–V yellow; VI–VIII brown.

Range.—(Europe) Widespread throughout Europe. (Asia) China, India, Israel, Japan, Korea, Mongolia, Pakistan, Taiwan, Thailand, Turkey. (North America) U.S.A. [WA only], Canada [British Columbia]. (Oceania) Australia, Philippines.

Hosts.—Various species of plants. Intercepted from the Netherlands on: *Allium* sp. (cutflowers), *Astilbe* sp. (cutflowers), *Crocus/Erenurus* sp. (cutflowers), *Delphinium* sp. (cutflowers), *Gentiana* sp. (cutflowers), *Lisianthus* sp. (cutflowers), *Lysimachia* sp. (cutflowers), *Scabiosa* sp. (cutflowers), *Solidago* sp. (cutflowers), *Viburnum* sp. (cutflowers).

Frankliniella occidentalis (Pergande, 1895)
(Figs. 3, 9, 15, 20–22, 24)

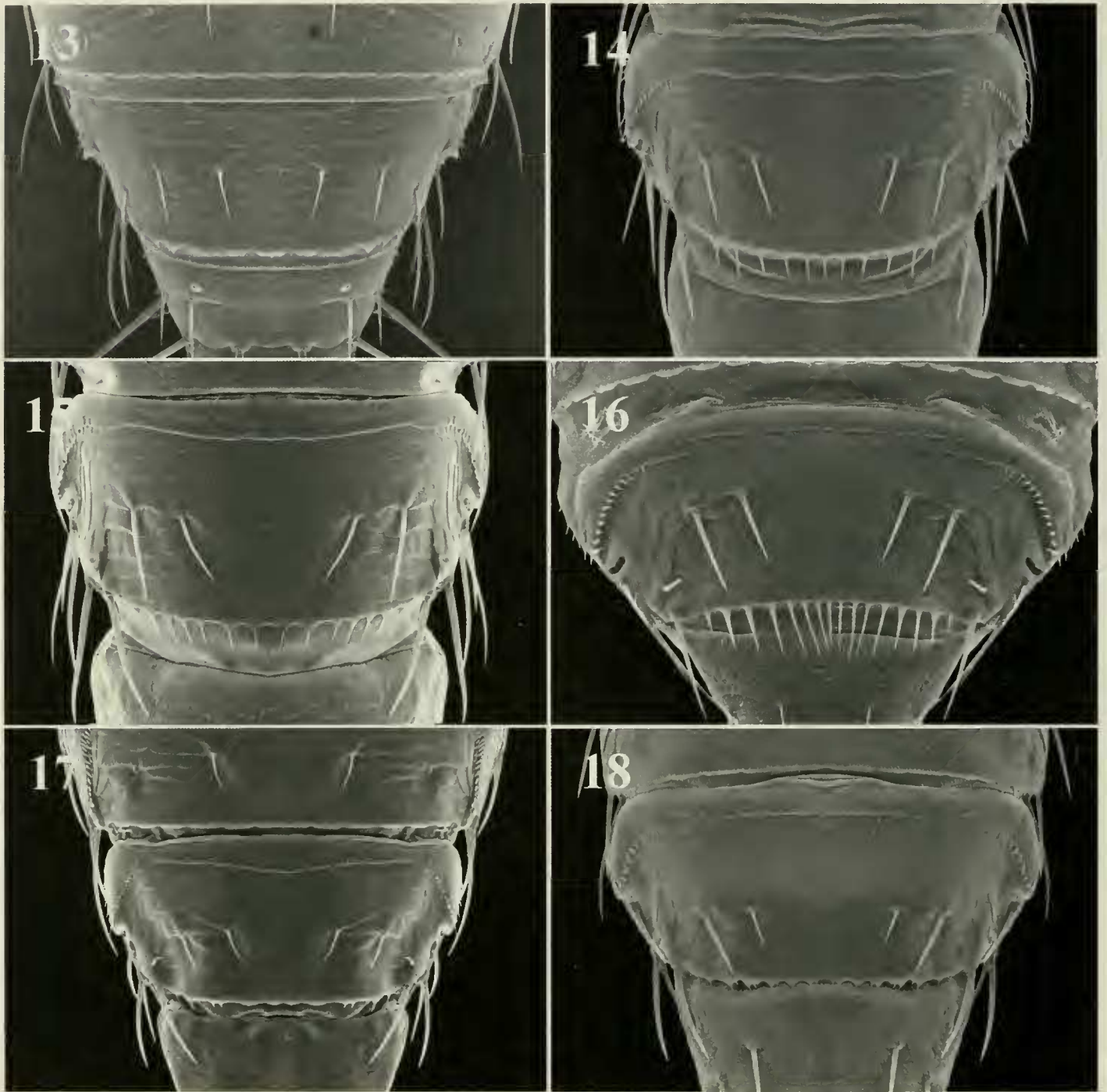
The western flower thrips, *F. occidentalis* is widespread throughout the world and frequently reaches pest status on a variety of crops. On the other hand, it also feeds on spider mites, and in California it has been

used as part of several insect pest management programs. It is the second most commonly intercepted thrips species [*Thrips tabaci* Lindeman is the most commonly intercepted species]. Although it probably originates in western North America, it has been transported throughout the world and is well established throughout Europe, Africa, and the Mediterranean. *Frankliniella occidentalis* can be distinguished from other *Frankliniella* species by the following features: Antennal segment VIII approximately twice as long as VII (Fig. 20); postocular setae IV significantly greater than one half as long as ocellar setae III (Fig. 3); metanotal campaniform sensilla present; and a complete complement of long microtrichia evenly spaced on posterior margin of abdominal tergite VIII as in Fig. 15. Sculpturation of metanotum as in Fig. 9.

Color.—Variable, but usually as follows: body yellow with abdominal tergites medially brownish; wings clear to light yellow; legs distally yellow, basally brown or yellow; head and pronotum yellow to light brown. Antennal segment I yellow; II brown; III yellow to light brown; IV–V partly yellow, VI–VIII brown.

Range.—(Europe) Widely distributed, including Italy (It), Netherlands (Ne). (Africa) Canary Islands, Kenya, South Africa, Swaziland. (Asia), Israel, Japan, Korea, Thailand. (Oceania) Australia, New Zealand. (North America) U.S.A., Canada, Central America, Mexico. (South America) Widespread.

Hosts.—Various species of plants. Intercepted from material from the Netherlands on: *Achillea* sp., *Ageratum* sp., *Allium* sp. (cutflowers), *Alstroemeria* sp., *Ammi majus*, *Atriplex* sp. (cutflowers), *Bouvardia* sp., *Capsicum* sp., *Capsicum annuum*, *Celosia cristata*, *Chrysanthemum* sp., *Cystisus* sp., *Freesia* sp., *Genista* sp. (cutflowers) (It), *Ixia* sp. (cutflowers), *Lisianthus* sp. (cutflowers), *Matthiola* sp. (cutflowers), *Mentha* sp., *Ornithogallum* sp., peonies, *Phlox* sp., *Rosa* sp., *Scabiosa* sp. (cutflowers),



Figs. 13–18. Abdominal tergites VIII of *Frankliniella* species, dorsal views. 13, *F. fusca*. 14, *F. intonsa*. 15, *F. occidentalis*. 16, *F. panamensis*. 17, *F. schultzei*. 18, *F. tenuicornis*.

Solidago sp. (cutflowers), *Trachelium* sp. (cutflowers).

Frankliniella pallida (Uzel, 1895)
(Figs. 23, 30)

Frankliniella pallida has seldom been intercepted at U.S. ports-of-entry.

Color.—Body pale tan to yellow.

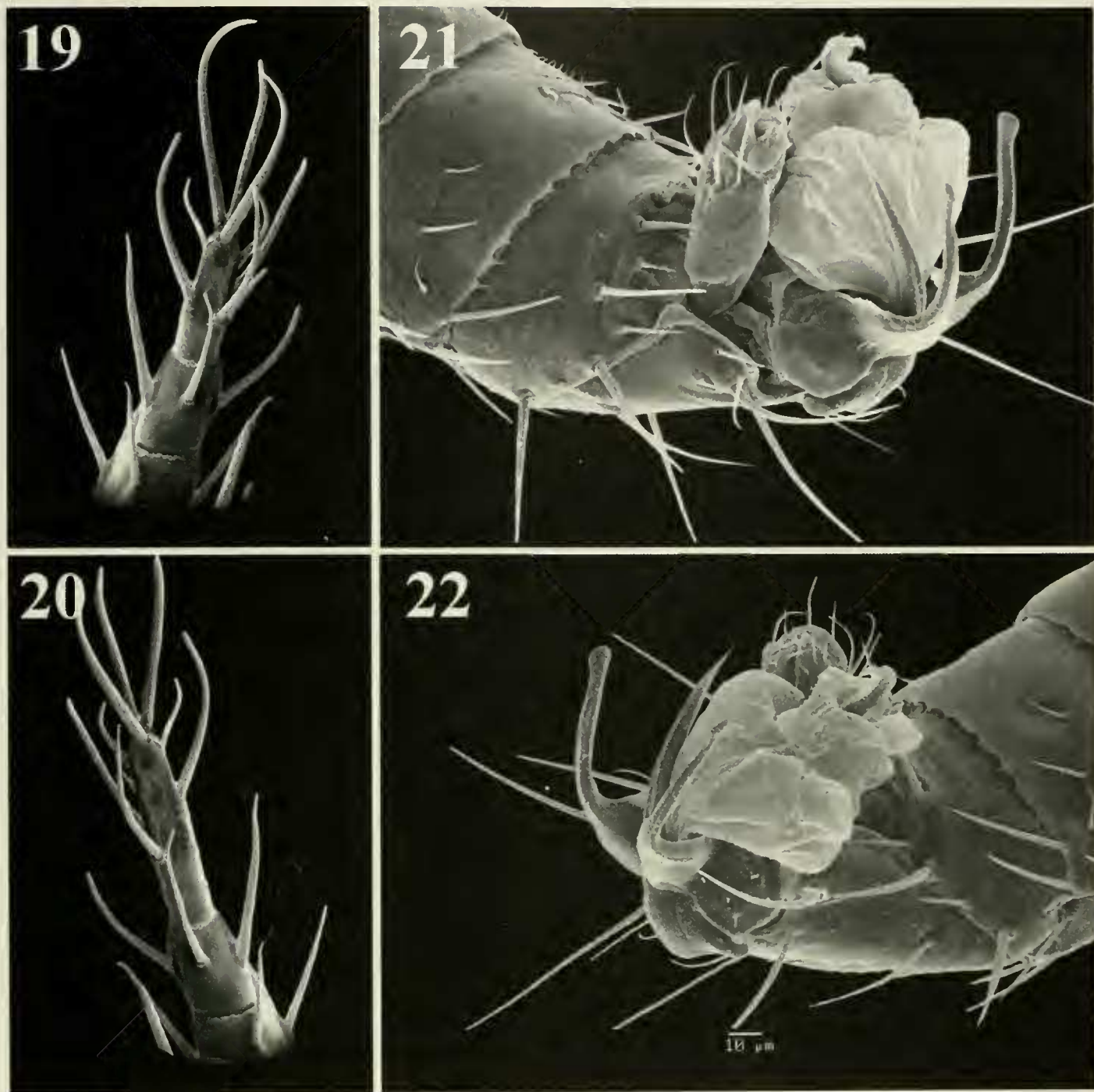
Range.—(Europe) Albania, Austria, former Czechoslovakia, Denmark, Germany, Finland, France, Hungary, Italy, Lithuania,

Netherlands, Poland, Romania, Russia, Sweden, Switzerland. (Asia) Siberia, Turkistan.

Hosts.—Wide variety of flowering plants. Intercepted between 1983 and 1999 on *Salvia* sp. from Greece [Louisville, KY].

Frankliniella panamensis Hood, 1925
(Figs. 4, 10, 16)

Frankliniella panamensis is a Neotropical species that as yet has not been established in other regions of the world, but



Figs. 19–22. Morphological features of *Frankliniella* species. 19–20, Antennal segments VII and VIII. 19, *F. intonsa*. 20, *F. occidentalis*. 21–22, *F. occidentalis*; male tip of abdomen. 21, Left dorsolateral. 22, Right dorsolateral.

several specimens have been intercepted at U.S. ports-of-entry from the Netherlands. It is regularly intercepted in ports-of-entry in shipments of flowers (especially on *Rosa* species), fruits, and vegetables from Colombia and Ecuador, and it may eventually be inadvertently transported to tropical areas of the Mediterranean and/or Africa. Although similar in appearance to *F. occidentalis*, it is often darker in color, and the microtrichia on the posterior margin of tergite

VIII are greater in length and closer together than those of *F. occidentalis*.

Color.—Body usually brown, with head and pronotum, tibiae, and portion of antennae often yellow; wings may be weakly shaded.

Range.—(North and South America) Panama, Colombia, Ecuador.

Hosts.—Usually on flowers, but also recently intercepted on a variety of vegetables and fruits.

Frankliniella schultzei (Trybom, 1910)
(Figs. 5, 11, 17)

Frankliniella schultzei is common throughout tropical regions of the world. Although originally not native to Africa, this species is now well established from Egypt and Morocco to South Africa and is frequently encountered in shipments arriving from various countries in Africa. It is found in nature in two color forms: dark brown and pale yellow. The dark form is known to be a vector of TSWV disease, but in Australia this color form is also known to be beneficial as a predator of phytophagous mites (Mound and Kibby 1998). In addition, it is a vector of the South African groundnut ringspot virus and tomato chlorotic spot virus (Wijkamp et al. 1995). It is an agricultural pest of a variety of crops, including tomatoes (Nakahara 1997). *Frankliniella schultzei* can be distinguished from other *Frankliniella* species by the position of the ocellar setae III between instead of in front of the posterior ocelli (Fig. 5), by the absence of microtrichia on abdominal tergite VIII (Fig. 17), and by the absence of metanotal campaniform sensilla. Sculpturation of metanotum as in Fig. 11.

Color.—Body yellow to light brown; wings clear to yellowish; legs yellow; head and pronotum yellow to light brown. Antennal segments I and II light brown; III yellow; IV–VIII light brown.

Range.—(Europe) Canary Islands, England, Italy, Netherlands (Africa) Widespread, including Cameroon, Chad, Congo, Egypt, Ethiopia, Gambia, Ghana, Kenya, Morocco, Namibia, Nigeria, Senegal, Somalia, South Africa (SA), Tanzania, Uganda, Zaire, Zimbabwe, Southwest Africa. (Asia) Widespread, including China, India, Indonesia, Israel, Japan, Korea, Southeast Asia. (Oceania) Australia, Hawaii, Philippines. (North and South America) Argentina, Brazil, Central America, Caribbean Islands, Colombia, U.S.A. [FL only]. (Other) Jamaica.

Hosts.—Various species of plants. Inter-

cepted from: *Delphinium* sp. (cutflowers) (Ne), *Lysimachia* sp. (cutflowers) (Ne), *Moraea* sp. (cutflowers) (SA), *Ornithogalum* sp. (cutflowers) (Ne).

Frankliniella tenuicornis (Uzel, 1895)
(Figs. 6, 12, 18)

Frankliniella tenuicornis is found primarily on grasses, although it is not a pest of cereal crops. It is easily distinguished from other commonly intercepted *Frankliniella* species by the prolonged vertex of the head in front of the anterior margins of the compound eye (Fig. 6), only antennal segments III and IV yellow, all postocular setae short and often irregular in both numbers and alignment, and abdominal tergite VIII with irregular number of short microtrichia on posterior margin (Fig. 18). Sculpturation of metanotum as in Fig. 12.

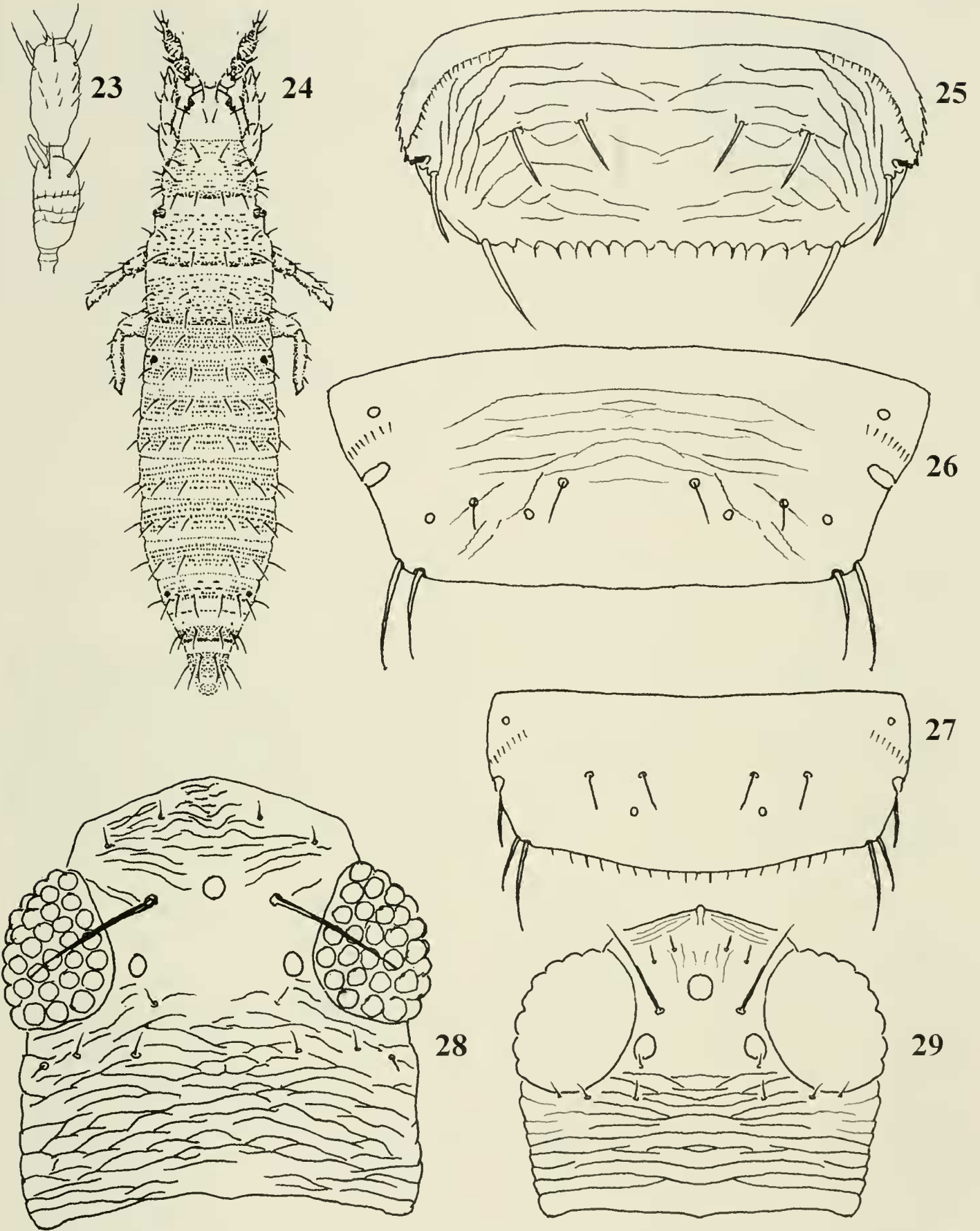
Color.—Body brown; wings clear; femora brown with bases and apices yellowish; head and pronotum brown. Antennal segments I and II brown; III and IV yellow; V–VIII brown.

Range.—(Europe) Austria, Balkans, Denmark, England, Germany, Finland, Italy, Netherlands, Poland, Romania, Russia, Scotland, Sweden. (Asia) China, Israel, Japan, Mongolia, Turkey. (Africa) Libya. (North America) Canada, U.S.A. (Australasian) Australia.

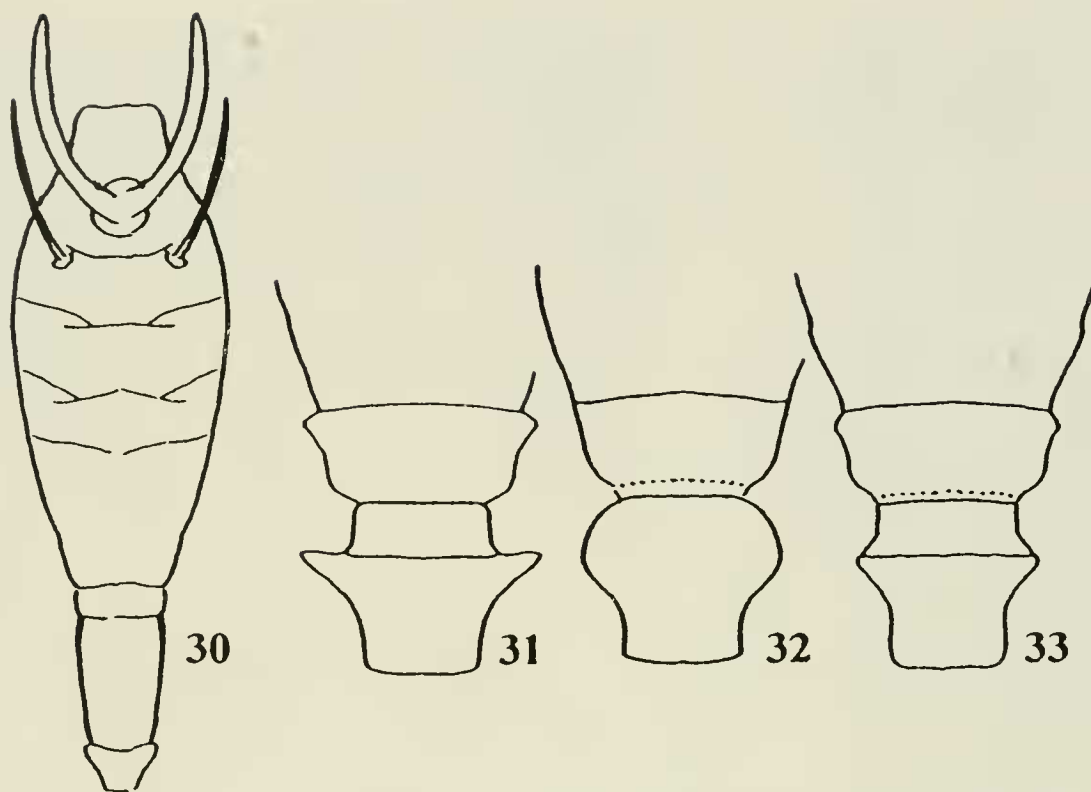
Hosts.—Cereals, various grasses, varieties of flowers, *Iris* sp. All interceptions from the Netherlands: *Chicorium* sp. (cutflowers), *Consolida* sp. (cutflowers), *Iris* sp. (cutflowers), *Ornithogallum* sp. (cutflowers).

Frankliniella tritici (Fitch, 1855)

Frankliniella tritici is a New World species recently intercepted twice in material from the Netherlands. Because it is a common species on a variety of North American commodities, it may make its way to other countries in Europe, the Mediterranean, and Africa, where it may become established.



Figs. 23-29. Morphological features of *Frankliniella* (24-25, 30-33) and *Iridothrips* species (23, 26-29). 23, Antennal segments III-IV, *I. iridis*, showing simple sense cones. 24, 2nd instar larva, *F. occidentalis*. 25-27, Abdominal tergite VIII. 25, *F. pallida*. 26, *I. iridis*. 27, *I. mariae*. 28-29, Head, dorsal view. 28, *I. iridis*. 29, *I. mariae*.



Figs. 30–33. Antennal segment II, showing basal pedicel. 30, *Frankliniella fusca*. 31, *F. borinquen*. 32, *F. tritici*. 33, *F. pallida*.

Range.—(North America) Canada, U.S.A. (South America) Argentina.

Hosts.—Found on a wide variety of plants and often a pest species on many agricultural crops. Intercepted from the Netherlands on *Freesia* sp. [Atlanta, GA] and *Delphinium* sp. [Dallas, TX].

Iridothrips Priesner, 1940

Diagnosis.—Head as wide as long or longer than wide; antenna 8-segmented; antennal segments III and IV each usually with simple sense cones (occasionally with fork sense cones) (Fig. 23); 3 ocelli present; 3 pairs of ocellar setae, with interocellar setae well developed and located laterad of anterior ocellus or only slightly posteriad of anterior ocellus; 4 postocular setae, all short and nearly equal in length; maxillary palpi 3-segmented; pronotum with 1 short pair of anteroangular, 1 long pair of anteromedial, and 2 long pairs of posteroangular setae and with 2–3 pairs of short anteromarginal and 5 pairs of posteromarginal setae; usually macropterous, with two complete rows of veinal setae regularly distributed on forewings; median pair of metanotal setae lo-

cated well posterior of anterior margin; intercoxal metathoracic process broad, truncate (at least for *I. iridis*); tarsi 2-segmented; ctenidia weakly to moderately defined on abdominal tergites V–VIII, on VIII located anterolaterad of spiracle; abdominal segment X longer than segment IX.

Iridothrips iridis (Watson, 1924) (Figs. 23, 26, 28)

Although infrequently intercepted, *Iridothrips iridis* occasionally is found associated with *Iris* sp. flowers and leaves. It is distinguished from its sister species, *I. mariae*, by the shape of the head (*cf* Figs. 28 and 29) and body color: *I. iridis* is usually dark brown, while *I. mariae* is pale yellow).

Color.—Body brown to dark brown with base of head, antennal segments III and IV, foretibiae, and all tarsi yellow; wings pale yellow; femora brown with bases and apices yellowish; head and pronotum brown.

Range.—(Europe) Austria, former Czechoslovakia, Denmark, England, Germany, Finland, France, Hungary, Netherlands, Poland, Scotland, Ukraine. (North America)

Canada [Montreal], U.S.A. [KS, IL, MA, MD, NH, NJ, NY, OH, OR, PA, VA, WA].

Hosts.—A pest of *Iris* spp.; *Kniphofia uvaria*; *Tritonia uvaria*. Intercepted from *Iris* sp. (cutflowers) (United Kingdom).

Iridothrips mariae Pelikán, 1961
(Figs. 27, 29)

Iridothrips mariae as yet has not been intercepted at U.S. ports-of-entry.

Color.—Body pale tan to yellow.

Range.—(Europe) former Czechoslovakia; Netherlands; Romania; Ukraine.

Hosts.—*Typha latifolia*; *Typha angustifolia*.

ACKNOWLEDGMENTS

I express sincere appreciation to Joseph Cavey, USDA/APHIS, Hyattsville, MD, and Peter Touhey, Systematic Entomology Laboratory, USDA, Beltsville, MD, for providing information for the databases, Sueo Nakahara (retired), and Douglass R. Miller and Michael Pogue, SEL, USDA, for their comments in reviews of the manuscript. Specimens were prepared for SEMs by Suzanne Braden and Scott Whittacker, Scanning Electron Microscope Laboratory, National Museum of Natural History, Smithsonian Institution, Washington, DC.

LITERATURE CITED

- Bagnall, R. S. 1926. Brief descriptions of new Thysanoptera. XV. *Annals and Magazine of Natural History* (9)18: 98–114.
- Fitch, A. 1855. The wheat thrips and three-banded thrips. *Country Gentleman* 88: 86–88.
- Hinds, W. E. 1902. Contribution to a monograph of the insects of the order Thysanoptera inhabiting North America. *Proceedings of the United States National Museum* 26: 79–242.
- Hood, J. D. 1925. New species of *Frankliniella* (Thysanoptera). *Bulletin of the Brooklyn Entomological Society* 22: 71–83.
- . 1936. *Frankliniella gossypiana* new name. *Proceedings of the Biological Society of Washington* 49: 68.
- . 1942. A century of new American Thysanoptera. III. *Revista de Entomologia Rio de Janeiro* 12: 547–678.
- Karny, H. 1910. Neue Thysanopteren der Wiener Gend. *Mitteilungen des Naturwissenschaftlichen Vereins an der Universität Wien* 8: 41–57.
- Jacot-Guillarmod, C. F. 1974. Catalogue of the Thysanoptera of the world. *Annals of the Cape Province Museum* 7(3): 517–976.
- Linnaeus, C. 1758. *Systema naturae*. Thrips 1. 10th ed. Stockholm, Sweden. p. 407.
- Moulton, D. 1928. Thysanoptera from Abyssinia. *Annals and Magazine of Natural History* (10)7: 227–248.
- Mound, L. A. and G. Kibby. 1998. Thysanoptera. An Identification Guide, 2nd Edition. CAB International. Wallingford, U.K. 70 pp.
- Mound, L. A. and S. Nakahara. 1993. The genus *Frankliniella* (Thysanoptera, Thripidae): Character assessment at generic and specific levels. *Advances in Thysanopterology, Zoology (Journal of Pure and Applied Zoology)* 4: 287–295.
- Nakahara, S. 1997. Annotated list of the *Frankliniella* species of the World (Thysanoptera: Thripidae). *Contributions on Entomology, International* 2: 355–389.
- Nakahara, S. and G. Vierbergen. 1998. Second instar larvae of *Frankliniella* species in Europe (Thysanoptera: Thripidae). *Proceedings of the Sixth International Symposium on Thysanoptera*. Antalya, Turkey. April 27–May 1, 1998, pp. 113–120.
- Nickle, D. A. 2003. A checklist of commonly intercepted thrips (Thysanoptera) from Europe, the Mediterranean, and Africa at U.S. ports-of-entry (1983–1999). Part 1. Key to genera. *Proceedings of the Entomological Society of Washington* 105: 80–99.
- Pelikán, J. 1961. New species of Thysanoptera from Czechoslovakia—IV. *Acta Societatis Entomologicae Czechosloveniae* 58: 60–70.
- Pergande, T. 1895. Observations on certain Thripidae. *Insect Life* 7: 390–395.
- Priesner, H. 1920. Beiträg zur Kenntnis der Thysanopteren Oberösterreichs. *Jahresbericht des Museum Francisco Carolinum* 78: 50–63.
- . 1938. *Thysanopterologica*, VI. *Konowia* 17: 29–35.
- . 1940. *Thysanopterologica*, IX. *Philippine Journal of Science* 71: 403.
- Trybom, F. 1895. Iakttagelser om vissa Blåsfotingars (Physapoders) uppträdande i gräsens blomställningar jämte några drag ur släktet *Phloeothrips* utvecklingshistoria. 60. *Entomologisk Tidschrift* 16: 157–194.
- . 1910. Leonhard Schultze, zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika (1903–1905). *Denkschriften medicinisch-naturwissenschaftlichen Gesellschaft zu Jena* 16: 147–174.
- Uzel, H. 1895. *Monographie der Ordnung Thysanoptera*. Königgratz, Böhmen. 472 pp.
- Vierbergen, G. 1995. The genus *Frankliniella* in the

- Netherlands, with a key to the species (Thysanoptera: Thripidae). *Entomologische Berichten*, Amsterdam 55: 185-192.
- Watson, J. R. 1924. A new *Bregmatothrips* (Thysanoptera) from England and Holland. *Entomologist's Monthly Magazine* 253-254.
- Wijkamp, I., N. Almarza, and D. Peters. 1995. Median latent period and transmission of tospoviruses vectored by Thrips. *In* Parker, B. L., M. Skinner, and T. Lewis, eds. *Thrips Biology and Management*. Plenum Press, New York. 636 pp.